Assessment of Treatment of Under-fives with Non-Malarial Fevers in the Lake Zone, Tanzania

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Acronyms

BS	Blood Smear
CI	Confidence Interval
CSF	Cerebrospinal Fluid
DMO	District Medical Officer
FBP	Full Blood Picture
HB	Hemoglobin
HW	Health-Worker
IMCI	Integrated Management of Childhood Illness
IRB	Institutional Review Board
MDG	Millennium Development Goal
MRDT	Malaria Rapid Diagnostic Test
NIMR	National Institute for Medical Research
OR	Odds Ratio
PI	Principal Investigator
RA	Research Assistant
RBG	Random Blood Glucose
RMO	Regional Medical Officer
THP	Tibu Homa Program
URC	University Research Council
USAID	United States Agency for International Development
UTI	Urinary Tract Infection
WHO	World Health Organization

EXECUTIVE SUMMARY

Over prescription of anti-malarials and antibiotics continues to be among the major public health problems in Africa. For malaria, misdiagnosis may limit the effectiveness of current efforts to decrease the burden of disease. For bacterial infections it may lead to adverse impacts on individual and population health through development of resistance to antibiotics and antimalarials in the community. The government of Tanzania through the Ministry of Health and Social Welfare in collaboration with various stakeholders is supporting interventions to reduce childhood morbidity and mortality from febrile illness. The Tibu Homa Program (THP) is implementing a comprehensive program to manage common causes of morbidity and mortality among under-fives in Regions of the Lake Zone. THP conducted a study to determine clinician prescribing practices for children under the age of five who test negative for malaria in the Lake Zone.

Objectives

To determine prescribing practices for non-malarial fever cases among under-fives in the Lake Zone of Tanzania

Methodology

This quasi-experimental, hospital-based study was conducted in health facilities of the Lake Zone Regions (Mwanza, Kagera and Shinyanga). Equal selection was done for each of the control and intervention arms. The intervention arm was THP supported facilities (Two hospitals, two health centers and four dispensaries). The control was non-THP supported facilities (two hospitals, two health centers and four dispensaries). Public and private facilities were included in both arms. Information on how non-malarial fever was managed was obtained from a review of patient records. Analyses involved descriptive statistics and comparisons of means using t-test with p-value of less than 0.05 indicating a differences between THP-supported and non-THP-supported sites.

Findings

Overall the proportion of clinicians using irrational prescription of antimalarial drugs to malaria-negative-under-fives was 10.1% [95%CI: 8.3 – 12.1]. In non- THP supported facilities, irrational prescription was significantly higher at 13.9% [95%CI=11.0 - 17.3] than that found in THP supported health facilities of, 6.5% [95%CI=4.7 - 9.2]. Over-prescription of antibiotics to under-fives who did not have indication for a bacterial infection was 23.3% [95%CI: 11.8 – 35.1]. In summary, correct provisional diagnosis was made to 23.8% [95%CI=21.2, 26.5] of under-fives, correct final diagnosis based on correct examination and supported by laboratory results to 25.6% [95%CI= 23.0, 28.5]. Of all under-fives, 13.8% [95%CI=11.7, 16.0] had a correct prescription of antibiotics based on final diagnosis.

Conclusion

A high proportion of clinicians in the Lake Zone of Tanzania are prescribing anti-malarial and anti-biotic medications inappropriately to children under-five. Although these problems are significantly lower in THP-supported health facilities there is still need to address them to alleviate adverse serious outcomes. THP interventions that include training of HCWs and Health Managers, monthly supportive supervision and mentorship visits to health facilities as a package have shown significant improvement in the management of non-malarial fever in under-fives. Enhanced training, comprehensive supportive supervision and mentorship may reduce this erroneous practice.

1.0 INTRODUCTION

The Government of the United Republic of Tanzania is fully committed to achieving the Millennium Development Goals (MDGs) as part of the National Strategy for Growth and Reduction of Poverty. Current estimated under-five mortality in Tanzania is 81 per 1,000 live births, infant mortality rate is 51 per 1,000 live births and newborn mortality is 26 per 1,000 live births[1]. Despite progress being made, under-five mortality, especially among neonates, remains high[1]. More than 70% of deaths in under-five children are due to diarrhoea, malaria, malnutrition, and pneumonia. According to WHO in 2006, it was estimated that 21% of deaths were due to pneumonia, 23% due to malaria, 27% due to neonatal complications and 17% due to diarrhoea with malnutrition cutting across[2].

In Tanzania, malaria has until the mid-2000s been responsible for over 18 million cases, 100,000 deaths/year and accounted for over 43% of outpatient cases, 30% of all hospital admissions and 40% of deaths occurring at health facilities[3]. This is despite reports indicating that malaria prevalence has declined in most parts of the country [4 5, 6, 7, 8.] The most recent Tanzania HIV and malaria indicator surveys (THMIS) conducted in 2011/2012 showed malaria prevalence declined by 50% since 2007 from 18% to 9%. The highest prevalence (33%) was in the North-western region of Geita near Lake Victoria and the lowest (<1%) in several regions of North-western, Central, Southern highlands and Zanzibar Island (MoH, unpublished data). Studies conducted in the Muheza district of north-eastern Tanzania showed a concurrent decline of malaria incidence among hospitalized children, as well as community acquired bacteraemia, suggesting that the decline in malaria burden is also affecting trends of bacterial infections [5].

Studies in Tanzania have shown that service provision for malaria case management has improved in terms of coverage. In studies from 2008/2009 and 2012, the capacity for malaria diagnosis and treatment was reported to be available in over 80% of facilities in Tanzania [9, 10 11]

Introduction of the malaria rapid diagnostic test (mRDT) has reduced unnecessary use of antimalarial drugs[11, 12] while availability of Artemisinin-based Combination Therapy (ACT) has remained constant with 77-80% of the facilities having the first-line antimalarial drug in stock in 2008/2009 and 2012. The new National Malaria Treatment Guidelines which has been integrated into IMCI training guidelines and treatment protocols directs treating malaria only after a positive malarial test [13].

University Research Co., LLC (URC) is implementing a five year (2011-2015) USAID-Tanzania funded program to improve the diagnosis and management of severe febrile illness in children under-five years in the Lake Zone of Tanzania. The program has been tracking several indicators including the progress made in testing all under- fives with febrile illnesses with mRDT or microscopy. For under- fives with fever who had lab confirmed malaria, the program is also tracking whether they received anti-malarial medications according to national policy. So far there has been significant progress on

testing under-fives with fever in the Lake Zone, Mwanza, Mara and Kagera regions (from 52% in June 2012 to 88% in December 2013).

Similarly, from January to December 2013, anti-malarial prescriptions according to national policy were maintained at over 91% for outpatient under-fives with lab confirmed malaria in the THP lake zone sites (THP quarterly reports). The program also tracked whether under-fives with fever were managed according to the IMCI algorithm. However, the program did not track medications prescribed for each diagnosis made.

THP carried out an assessment of the management of under-fives with fever who tested negative with mRDT or Malaria microscopy in facilities supported by the program and compared them with under-fives from health facilities not supported by the program. This assessment also determined whether there is rational use of anti-malarial medications after implementation of the new IMCI guidelines.

2.0 OBJECTIVE

2.1 Main Objectives

The objective of the assessment was to determine treatment provided for non-malarial fever cases of children under-fives in the Lake Zone.

2.2 Specific Objectives

i. Determine the proportion of children under-five with non-malarial fever who received anti-malarial medication in THP and non-THP supported facilities.
ii. Determine the proportion of under-five children with non-malarial fever who received antibiotics without an indication of bacterial cause from diagnostic testing in THP and non-THP supported facilities.

3.0 METHODOLOGY

3.1 Study Design

The assessment was a quasi-experimental facility-based design. The *intervention arm* included a sample of health facilities supported by THP and the *control arm* was a sample of health facilities not supported by THP. Matching was done by type and ownership (public and private) of the health facilities.

3.2 Target Area

The program covered six regions namely Mwanza, Geita, Mara, Kagera, Shinyanga and Simiyu. However, only two regions (Mwanza and Kagera) were selected because they were socio-culturally representative of the 6 regions. From each of the selected regions, one district hospital, two health center and four dispensaries were included in the assessment (Table 1). In addition, the study selected two hospitals from Shinyanga region to compensate for public and private hospitals that could not be found in the control arm.

Table 1. Health facilities by level, ownership and study arm selected for the study

Level	Intervention arm		Control arm	
Hospitals	Nyamagana – Mwanza (Public)	Rulenge – Kagera (Private)	Kahama – Shinyanga (Public)	Magai – Shinyanga (Private)
Health Centers	AICT Makongoro – Mwanza (Private)	Kaigara – Kagera (Public)	Kiloleli Juu – Mwanza (Private)	Izigo – Kagera (Public)
Dispensaries	Nyakahoja – Mwanza (Private)	Buhembe – Kagera (Public)	Kirumba – Mwanza (Public)	Katoke – Kagera (Public)
	Imani ELCT – Mwanza (Private)	Kagemu – Kagera (Public)	Nyasaka – Mwanza (Private)	Rwigembe – Kagera (Private)

3.3 Study Population

The study involved records of under-five children who experienced fever but tested negative with mRDT or microscopy.

Inclusion criteria: Children under- five with fever and negative malaria laboratory results

Exclusion Criteria: Children aged five years and above with fever and positive malaria laboratory results.

3.4 Sample Size Estimation

A minimum sample of 1,080 records of children aged less than five years estimated for recruitment on equal allocation of 540 per study arm. This sample size was calculated to detect at least a 10 percent difference between study arms with 80 percent power and a 95 percent confidence interval. Oversampling was applied to take into consideration study individuals per level of health facility (higher level facilities have higher numbers of patients as compared to the lower level).

Table 2. Estimated number of records by facility level per arm (public or private)

Facility level	Number of sites	Records	Total records
Hospital	2	110	220
Health Centre	2	80	160
Dispensary	4	40	160
Total			**540**

There was no random selection of records per site. To have a common starting point, records were reviewed backwards from the date of visit until the required sample indicated in Table 2 was obtained. Nevertheless, for the intervention area, the review did not go beyond the time before THP intervention in the respective facility.

3.5 Data Collection

Data were collected from each facility as described below. Rather than using exit patient-assessment (assess records of children while they are at the health facility), the study teams reviewed (historical) available records of under-fives. The assessment process used a pre-tested questionnaire to collect quantitative data.

3.6 Study Tool

The main data collection instrument was a questionnaire developed by pediatricians and social scientists in collaboration with the Strategic Information Specialist at THP. The tool collected background information on diagnosis, laboratory tests and results, final diagnosis and medications prescribed by clinicians, and reviewers' assessment of final diagnosis and management.

3.7 Data Processing and Analysis

Data were entered into Epi Info. Completeness of the tool was guaranteed by reviewing all forms during the evenings so as to maintain quality data. The unit of analysis was a child in the respective health facility. The outcome variables include (a) the proportion of children aged less than five years with non-malarial fevers who received anti-malaria medications, (b) the proportion of children aged less than five years with non-malarial fevers who receive antibiotics without an indication for bacterial cause in the differential diagnosis/classifications. Stratification of these proportions was done across study arms, ownership and health facility level. Statistical methods included univariate (frequencies), cross-tabulations and bivariate logistic regression analysis to estimate independent factors associated with prescription of anti-malarial drugs to under-fives with fever but without malaria.

3.8 Dependent Variables

1. Children under-five with non-malarial fever who received an anti-malarial
2. Children under-five with non-malarial fever who received antibiotics without an indication for bacterial cause.

3.9 Independent Variables

1. Age and sex of the child
2. Referral status of the child
3. In-patient or out-patient
4. Study arm
5. Health facility level
6. Health facility ownership

3.10 Ethics and Permission Considerations

Permission was sought and received from Regional Medical Officers (RMOs) and District Medical Officers (DMOs) and Health facility in-charges of selected facilities. For confidentiality, no names or other identifying information of patients were recorded during data collection such that there was not any possibility to link the results of the

assessment and individual patients. Furthermore no patient case files assessed were removed from the respective health facilities.

3.11 Recruitment and Training of Research Assistants

Four research assistants (RAs) with medical degrees and at least two years of experience in a medical related field served as data collectors. There were two supervisors from THP (a study coordinator and a paediatrics specialist) and a consultant statistician. All RAs were introduced to the objectives and were trained for the study and also received ethics training. The use of experienced clinicians made it possible to assess the performance of health care providers in the examination, diagnosis and in prescription practices objectively. In addition, trained data entry clerks were selected based on qualifications and on experience of accuracy in data entry.

3.12 Limitations of the Study

One potential limitation is the possibility for spill-over of advantages and benefits from the health facilities in the intervention arm to those in the control arm. This could be through the horizontal exchange of information between friends or colleagues or vertically by transfer of health personnel from health facilities in the intervention arm to those in the control arm and vice versa. In addition, matching was only done based on type and ownership of facilities, THP and non-THP facilities may therefore have differed in terms of characteristics in terms other characteristics that could have had an impact on the outcomes of interest.

4.0 FINDINGS

4.1 Description of Study Sample

The study reviewed 1,010 records 521 (51.6%) from the intervention arm and 489 (48.4%) from the control arm. The shortfall of the sample was due to insufficient records from some health facilities (Table 3). The number of under-fives in the assessment was as follows: 439 (43.5%) from hospitals; 284 (28.1%) from health centers and 287 (28.4%) from dispensaries. All under-fives tested malaria negative by BS microscopy or mRDT or both as it was the design of this assessment to look at the management of malaria negative febrile under-fives. A total of 572 (56.6%) tested negative using mRDT while 426 (42.2%) tested negative using BS microscopy and 12 (1.2%) tested negative using both tests.

Table 3. Distribution of under-fives by health facility and by study arm

Intervention arm		Control arm	
Name of health facility	**Number (%)**	**Name of health facility**	**Number (%)**
Nyamagana Hospital	109 (10.8)	Kahama Hospital	107 (10.6)
Rulenge Hospital	110 (10.9)	Magai Hospital	113 (11.2)
Kaigara HC	82 (8.1)	Izigo HC	82 (8.1)
AICT Makongoro HC	81 (8.0)	Kilololeli Juu Dispensary	39 (3.9)
Buhembe Dispensary	40 (4.0)	Kirumba Dispensary	40 (4.0)
Kagemu Dispensary	39 (3.9)	Katoke Dispensary	41 (4.1)
Nyakahoja Dispensary	41 (4.1)	Nyasaka Dispensary	19 (1.9)
Imani ELCT Dispensary	19 (1.9)	Rweigembe	48 (4.8)
TOTAL	**521 (100.0)**	Dispensary	**489 (100.0)**
		TOTAL	

Of all participants, 247 (24.5%) were inpatients, 753 (74.6%) outpatients and 10 (1.0%) had their inpatient/outpatient status not documented Only 18 (1.8%) were classified as referred and 129 (12.8%) had indication for referral but they were not referred, many from dispensary facilities. Referral information was not indicated for the majority of under fives, 611 (60.5%) and hereby classified as Not applicable and 252 (24.9%) under-fives were classified as ‘not documented because their referral status was not documented (Table 4).

Table 4. Distribution of under-fives by source

Characteristic	**Intervention arm**	**Control arm**	**TOTAL**
	Number (%)	**Number (%)**	**Number (%)**
Health facility level			
Hospital	219 (41.0)	220 (45.0)	439 (43.5)
Health centre	163 (31.3)	121 (24.7)	284 (28.1)
Dispensary	139 (26.7)	148 (30.3)	287 (28.4)
Referral status			
Yes	9 (1.7)	9 (1.8)	18 (1.8)
No	88 (16.9)	41 (8.4)	129 (12.8)
Not applicable	347 (66.6)	264 (54.0)	611 (60.5)
Not documented	77 (14.8)	175 (35.8)	252 (25.0)
Status of care	138 (26.5)	109 (22.3)	247 (24.5)
Inpatient	376 (72.2)	377 (77.1)	753 (74.6)
Outpatient	7 (1.3)	3 (0.6)	10 (1.0)
Not documented			

Table 5 presents study participants by age and by sex. Out of 884 under-fives, age records were not available for 126 (12.5%) (Not recorded). The median age, excluding those whose age was not recorded was 14 months. The study participants were almost equally distributed by sex: 49% for males and 51 for females.

Table 5. Distribution of under-fives by age and by sex

Characteristic	Intervention arm	Control arm	TOTAL
	Number (%)	Number (%)	Number (%)
Child's age (months)			
0 – 11	192 (43.8)	157 (35.2)	349 (39.5)
12 – 23	121 (27.6)	117 (26.2)	238 (26.9)
24 – 35	58 (13.2)	74 (16.6)	132 (14.9)
36 – 47	42 (9.6)	57 (12.8)	99 (11.2)
48 – 59	25 (5.7)	41 (9.2)	66 (7.5)
Sex			
Male	250 (48.0)	237 (48.3)	487 (48.2)
Female	267 (51.2)	236 (48.3)	503 (49.8)
Not indicated	4 (0.8)	16 (3.3)	20 (2.0)

4.2 Reported Recorded Symptoms

Table 6, illustrates the reported medical symptoms presenting for the past one week before visiting the health facility. Besides fever which was a criterion for selection, other most common medical symptoms include cough 486 (48.1%), diarrhoea 262 (25.9%) and vomiting 256 (25.3%).

Table 6. Reported medical symptoms for malaria-negative, febrile under-fives at admission

Medical symptom	Intervention arm	Control arm	TOTAL
	Number (%)	Number (%)	Number (%)
Cough	270 (51.8)	216 (44.2)	486 (48.1)
Diarrhea	137 (26.3)	125 (25.6)	262 (25.9)
Vomiting	151 (29.0)	105 (21.5)	256 (25.3)
Difficulty in breathing	32 (6.1)	23 (4.7)	55 (5.4)
Body weakness	15 (2.9)	33 (6.7)	48 (4.8)
Convulsions	16 (3.1)	12 (2.5)	28 (2.8)
Pain when urinating	5 (1.0)	2 (0.4)	7 (0.7)
Ear discharge	5 (1.0)	1 (0.2)	6 (0.6)
Unable to feed	4 (0.8)	1 (0.2)	5 (0.5)

Based on reported signs and symptoms, the following provisional diagnoses or classifications were made (Table 7). The main provisional diagnoses were respiratory tract infection with a total of 171 (16.9%), pneumonia with 149 (14.8%) and urinary tract infection with 103 (10.2%).

Table 7. Presenting diagnosis for under-fives

Provisional diagnosis	Intervention arm	Control arm	TOTAL
	Number (%)	Number (%)	Number (%)
RTI	121 (23.2)	50 (10.2)	171 (16.9)
Pneumonia	74 (14.2)	75 (15.3)	149 (14.8)
UTI	75 (14.4)	28 (5.7)	103 (10.2)
Anemia	17 (3.3)	19 (3.9)	36 (3.6)
Cough or cold	10 (1.9)	18 (3.7)	28 (2.8)
Worm infestation	16 (3.1)	11 (2.2)	27 (2.7)
Dysentery	5 (1.0)	3 (0.6)	8 (0.8)
Typhoid fever	2 (0.4)	4 (0.8)	6 (0.6)
Measles	4 (0.8)	0 (0.0)	4 (0.4)
Septicemia	2 (0.4)	2 (0.4)	4 (0.4)
Malnutrition	3 (0.6)	0 (0.0)	3 (0.3)
Meningitis	1 (0.2)	1 (0.2)	2 (0.2)

4.3 Requested Laboratory Investigations

The documented major laboratory investigations for under-fives included malaria microscopy (blood smear) 429 (42.5%), malaria rapid diagnostic test 584 (57.8%), HB 263 (26.0%), urinalysis 159 (15.7%) and stool microscopy 134 (13.3%) (Table 8).

Table 8. Investigation performed/ laboratory requested

Investigation performed	Intervention arm	Control arm	TOTAL
	Number (%)	Number (%)	Number (%)
mRDT	326 (62.6)	258 (52.8)	548 (57.8)
BS	197 (37.9)	232 (47.4)	429 (42.5)
HB	92 (17.7)	171 (35.0)	263 (26.0)
Urinalysis	114 (21.9)	45 (9.2)	159 (15.8)
Stool microscopy	90 (17.3)	44 (9.0)	134 (13.3)
Widal test	3 (0.6)	18 (3.7)	21 (2.1)
HIV test	2 (0.4)	5 (1.0)	7 (0.7)
RBG	1 (0.2)	3 (0.6)	4 (0.4)
FBP	1 (0.2)	1 (0.2)	2 (0.2)
CSF	0 (0.0)	1 (0.2)	1 (0.1)
Urine culture	1 (0.2)	0 (0.0)	1 (0.1)

4.4 Diagnosis and Prescribed Medications

Various medications for different diagnoses were prescribed to under-fives (Table 9). The most common prescribed drugs were paracetamol, Amoxyllin/Ampiclox/PEN V and

Gentamycin. Under-fives who were prescribed multiple medications were those diagnosed with UTIs and pneumonia. Of those with UTIs, two under-fives were treated with piriton and five with Zinc. Therefore, it seems the medications prescribed could be targeting other associated conditions like acute watery diarrhea in case of zinc (not analyzed).

The group of other prescribed medicines includes a whole range of medicines especially medicines that are not for major childhood illnesses. Included are medicines like anti pyretics/analgesics, anti- worms etc.

Table 9. Number of malaria test negative under-fives given various medications at final diagnosis by study arms

	Intervention arm								**Control arm**							
	Final diagnosis								**Final diagnosis**							
Name of medication	**a**	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**a**	**b**	**C**	**d**	**e**	**f**	**g**	**h**
Antibiotics	1	0	4	0	60	1	119	209	1	0	5	1	35	0	83	323
Zinc	0	0	0	0	5	0	1	79	0	0	0	0	0	0	1	45
Anti-anemia	0	0	0	0	2	1	4	26	0	0	0	0	2	0	1	20
Other	4	1	1	2	72	4	81	446	2	0	2	2	34	0	81	439
Key: **a**=Meningitis; **b**=Measles; **c**=Septicemia; **d**=Typhoid fever; **e**=UTI; **f**=Ear infections; **g**=Pneumonia; **h**=Anemia																
Antibiotics include, phenegan, Cotromoxazole, Nystatin, Metronidazole, Chloramphenical, Gentamycin, Amoxyllin/Ampiclox/PEN V, Ceftriaxone, X-pen, and PPF)																
Anti-anemia includes: Folic Acid, Iron, Vitamins																
Others: ORS, Priton, Phernagan																

4.5 Antimalarial Prescription and Associated Factors

Table 10 illustrates the association between prescription of antimalarial drugs and selected characteristics.

Table 10. Association of prescription of antimalarial drugs to malaria negative under-fives by background characteristics

	Total	Intervention	Control arm	χ^2, p-value
Characteristic	Number (%)	Number (%)	Number (%)	
Type of health facility				
Hospital	75	28 (12.8)	47 (21.4)	5.70, 0.017
Health Centre	(17.1)	4 (2.5)	7 (5.8)	1.27, 0.259
Dispensary	11 (3.9)	2 (1.4)	14 (9.5)	8.76, 0.003
Ownership of facility	16 (5.6)			
Public		10 (3.7)	49 (18.1)	28.94, <
Private	59	24 (9.6)	19 (8.7)	0.001
Sex of the child	(10.9)			0.11, 0.740
Male	43 (9.1)	19 (7.6)	34 (14.3)	
Female		15 (5.6)	30 (12.7)	5.71, 0.017
Referred patient	53			7.74, 0.005
Yes	(10.9)	3 (33.3)	3 (33.3)	
Not	45 (8.9)	7 (8.0)	7 (17.1)	0.25, 0.617

Admission status				1.55, 0.213
Inpatient	6 (33.3)	21 (15.2)	41 (37.6)	
Outpatient	6 (33.3)	12 (3.2)	26 (6.9)	16.25, < 0.001
	61 (25.1)			5.39, 0.020
	39 (5.1)			

In Table 10, among all records of under-fives, the overall the proportion of clinicians using irrational prescription of antimalarial drugs (Artemether Lumefantrine (ALu), Coartem, Comaquine, Quinine and Artesunate) to malaria-negative was 10.1% [95%CI: 8.3 – 12.1].

Prescription of these antimalarials (Artemether Lumefantrine (ALu), Coartem, Comaquine, Quinine and Artesunate) drugs among under-fives with fever who tested negative for malaria was significantly more (13.9%) in THP non-supported facilities than among THP supported health facilities (6.5%) [$\chi^2 = 15.13$, $p < 0.001$] especially in the primary health facilities and in patients who attended without referral. For that matter, it was significantly more than twice likely clinicians in the THP non-supported health facilities to prescribe antimalarial drugs to children with fever but without malaria than their counterparts [OR=2.3; 95%CI=1.5, 3.6]

The proportion of inpatient under-fives with fever who tested negative for malaria but received antimalarial drugs was significantly higher than outpatient under-fives (25.1% against 5.1%) [$\chi^2 = 83.12$, $p < 0.001$].

In all characteristics except privately owned facilities and non-referred under-fives, the proportion if under-fives getting irrational prescription of antimalarial drugs to malaria-non negative was significantly higher in facilities of the control arm than those in the intervention arm (Table 10).

4.6 Bacterial and Non-bacterial Illnesses among Under-fives

In this study, the main bacterial infections were meningitis, typhoid fever, UTI, septicemia, acute otis media, impetigo and tonsillitis. Non-bacterial diagnoses were anaemia, respiratory tract infections (RTI), cough or cold and diarrhoea. There were 778 (77.0%) under-fives diagnosed with at least one bacterial infection (Table 11).

Table 11. Bacterial and non-bacterial illnesses among under-fives

Type of infection	Intervention arm	Control arm	TOTAL
	Number (%)	Number (%)	Number (%)
Bacterial	375 (72.0)	403 (82.4)	778 (77.0)
Non-bacterial	146 (28.0)	86 (17.6)	232 (23.0)
RTI alone	121 (23.2)	50 (10.2)	171 (16.9)
Anemia alone	17 (3.3)	19 (3.9)	36 (3.6)28
Cough or cold alone	10 (1.9)	18 (3.7)	(2.8)
Diarrhea alone	1 (0.2)	0 (0.0)1	1 (0.1)
Multiple - non bacterial	3 (100.0)	1(100.0)	4 (100.0)

Overall, antibiotics were prescribed to 257 (25.4%) [95%CI: 22.8 - 28.3] under-fives with non-malarial fever. Prescription of antibiotics to under-fives was significantly associated with health facility level, whether the child was in-patient or not and whether the child had bacterial infection or not. However, there was no significant differences between prescription of antibiotics in THP and non-THP sites ($p>0.05$) (Table 12).

There was a higher proportion of prescriptions of antibiotics to in-patient under-fives (104 or 42.0%) than out-patient under-fives, (151 or 19.9%) ($p < 0.001$). Although a higher proportion of under-fives with bacterial infections were correctly given prescriptions, 228 (29.3%), some under-fives without bacterial infections also received antibiotics 29 (12.5%) ($p < 0.001$). This is the proportion of under-fives with fever that tested negative for malaria and do not have any bacterial infection yet were prescribed antibiotics.

Table 12. Association between incorrect prescribing of antibiotics to under-fives and selected characteristics

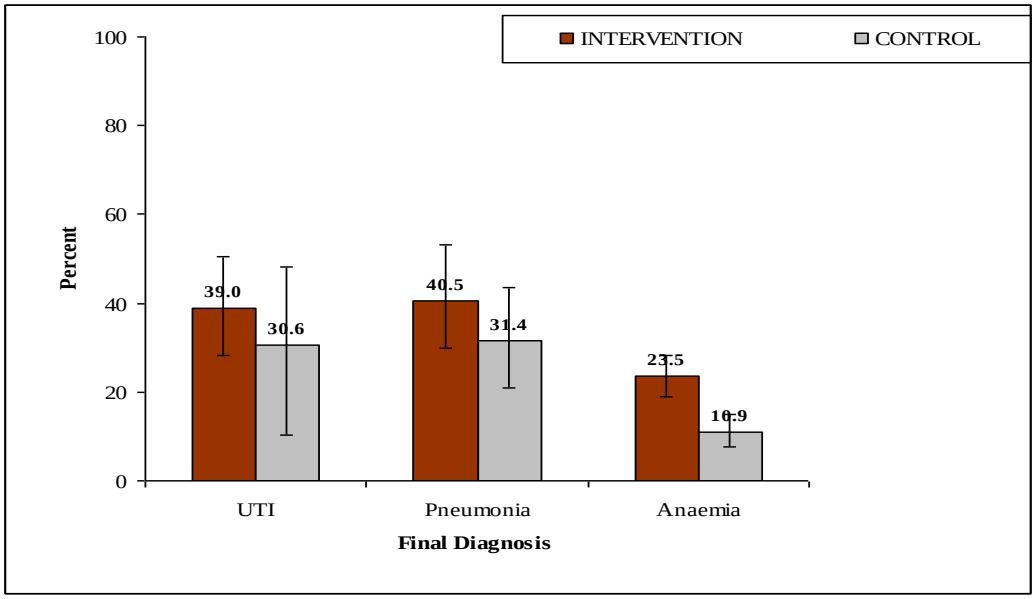
	Intervention	Control arm	TOTAL
Characteristic	Number (%)	Number (%)	Number (%)
Type of health facility			
Hospital	59 (26.9)	67 (30.5)	126 (28.7)
Health Centre	61 (37.4)	25 (20.7)	86 (30.3)
Dispensary	21 (15.1)	24 (16.2)	45 (15.7)
Ownership of facility			
Public	65 (24.1)	69 (25.6)	134 (24.8)
Private	76 (30.3)	47 (21.5)	123 (26.2)
Sex of the child			
Male	64 (25.6)	61 (25.7)	125 (25.7)
Female	76 (28.5)	53 (22.5)	129 (25.6)
Referred patient			
Yes	2 (22.1)	4 (44.4)	6 (33.3)
Not	29 (33.0)	9 (22.0)	38 (29.5)
Admission status			
Inpatient	65 (47.1)	39 (35.8)	104 (42.1)
Outpatient	73 (19.4)	76 (20.2)	149 (19.8)
Have bacterial infection			
Yes	122 (32.5)	106 (26.3)	228 (29.3)
No	19 (13.0)	10 (11.6)	29 (12.5)

4.7 Treatment of Common Illnesses

Research assistants made an assessment of each under-five medical record to determine if he/she received correct treatment by considering if the treatment received was the correct first line drug for the diagnosis made and if the dosage of the drug was

correctly estimated in amount and duration. Overall, 36.4% of under-fives with urinary tract infection (UTI) and 36.4% with pneumonia and 18.5% of under-fives with upper respiratory tract infection (URTI) received correct treatment (Figure 1).

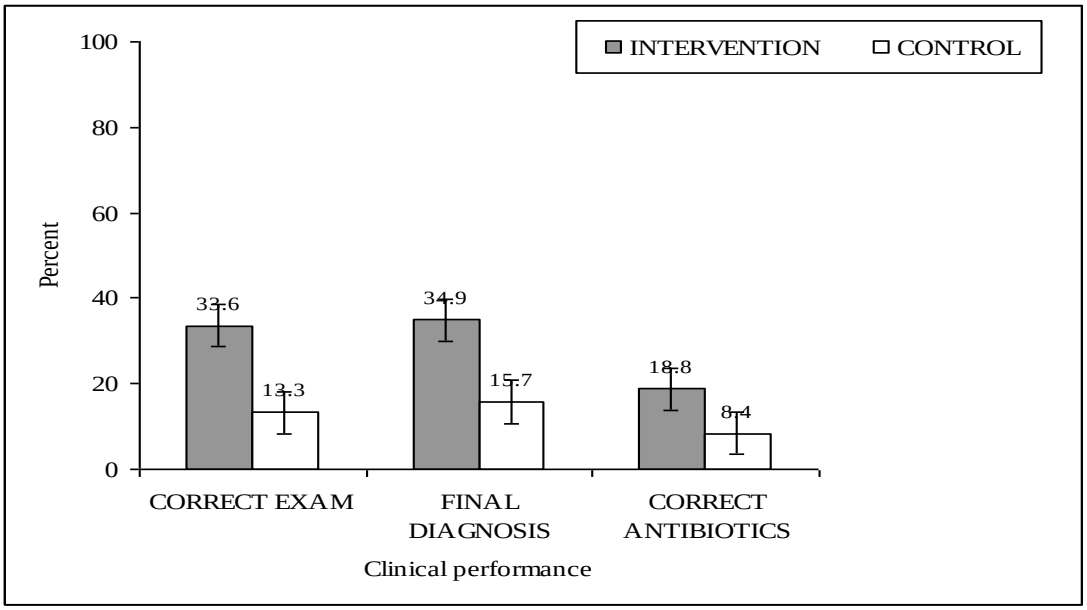
Figure 1. Percent of under-fives receiving the right treatment for diagnosis made



4.8 Assessment of Health Care Workers' Clinical Performance

After completing the assessment on treatment (correct diagnosis, medication and dosage), assessors concluded that 240 (23.8%) [95%CI: 21.2 - 26.5] of under-fives were examined correctly and a correct provisional diagnosis made but only a quarter, 259 (25.6%) [95%CI: 23.0 - 28.5] of under-fives had the final diagnosis correctly made based on examination results. A total of 139 (13.8%) under-fives received antibiotics prescription based on correct final diagnosis [95%CI: 11.7 - 16.0].

Figure 2. Clinical performance of clinicians by study arms



As indicated in Figure 2, there were significantly (error bars do not overlap) more under-fives attending health facilities in the intervention arm examined correctly based on correct provisional diagnosis, having correct final diagnosis based on correct examination results and receiving correct antibiotics based on final diagnosis than those attending facilities than their counterparts in the control arm. However, there were no statistical differences in the three parameters by health facility ownership (public or private) or level of health facility (hospital, health center or dispensary).

5. 0 DISCUSSION AND CONCLUSIONS

5.1 Discussion

This assessment determined clinicians' practices for non-malarial fever cases among children younger than five years in the Lake Zone using a quasi-experimental facility-based design. It compared practices of health care providers in the THP and non-THP supported health facilities.

With control efforts, put in place by the Government of Tanzania malaria reduced significantly as demonstrated by population based studies that have indicated a decline in overall malaria prevalence among under-fives from 18.1% in 2008 to 9.7% in 2012. WHO's integrated management of childhood illness (IMCI) strategy provides evidence-based guidelines for managing ill children in health facilities lacking sophisticated diagnostic equipment[4]. The use of parasite-based diagnosis allows better targeting of anti-malarial drugs, and also provides an opportunity for other causes of fever to be identified and appropriately treated.

However, anti-malarial prescription to patients with negative test results and those not tested is still practiced in Tanzania despite the universal malaria testing policy of fever patients[10 11 12].

Although reports indicate a decline in malaria episodes in some previously known malaria endemic areas[3-5], there have also reported challenges for the treatment of febrile illnesses especially in sub-Saharan Africa; one being the lack of diagnostic equipment and where equipment exists there are clinicians do not trust the results[6, 7]. With government support introduction of mRDT roll out, improved logistic management systems and training along with supportive supervision from THP to health care providers in the Lake Zone, these problems have decreased.

In Tanzania, causes of fever among under-fives without malaria have been recently documented as being mostly viral infections rather than of bacterial or parasitic[11, 12.14]. In this study, the most common diagnoses in non-malaria fever were UTI and pneumonia. The assessment found that study participants confirmed negative for malaria using malarial microscopy or mRDT were still prescribed anti-malarial drugs by clinicians up to 10% in children under-fives. This practice was observed more at hospitals than at health centers or dispensaries and it was not influenced by ownership of the health facility (private/public). Since it was observed more in inpatients than outpatients, it could be due to national malaria treatment guidelines that allow for malaria inclusive treatment at onset until the malaria results have been obtained to guide decision for severe febrile

cases[13]. A qualitative study on why clinicians do not give correct prescription would help in designing an intervention to address the problem.

THP observed a change in prescribing practice following regular coaching and mentorship visit. At the beginning of the intervention about 13% of non-malaria under-fives received an antimalarial. THP latest reports shows that currently about 3% of non-malaria children under-five received antimalarials (THP quarterly and annual reports). Similar improvements were reported in previous studies following improved laboratory diagnosis.[11 12]

In some previous studies improved adherence to national guidelines for malaria upon laboratory evidence was associated with increased use of antibiotics in non-malaria negative under-fives, [11] Management of bacterial infections was another challenge. Either health care providers did not prescribe antibiotics to eligible children or antibiotics were prescribed to those ineligible.

In this study, there were 778 (77.0%) under-fives diagnosed with at least one bacterial infection. The high prevalence of bacterial disease is partly due to coexistence of illnesses and partly due to poor compliance of health care workers to diagnostic/treatment algorithm and inadequate supervision/mentorship that is responsible for inappropriate prescriptions. The referral health facilities were also inadequately equipped to support diagnosis in non-malaria fevers [15]. Over-prescription of antibiotics has been previously reported in health facilities of Northern Tanzania and China.[16 17]

In this study, about 22% more in-patients received prescriptions for antibiotics than out-patients ($p < 0.001$).Similarly a significant number of under –fives with no bacterial infection received antibiotics 29 (12.5%) ($p < 0.001$).

Medication, dosage and treatment of many diseases for under-fives in the study area poor. Evidence is based on the three (RTI, UTI and pneumonia) diseases that had enough cases for the assessment. Although it may be difficult to conclude on these parameters (medication, dosage and treatment) for other diseases, it is possible that the situation is the same or worse. Poor management of these conditions may lead to adverse outcomes that include worsening of disease, drug resistance and mortality.

After completing the assessment on medication, dosage and treatment, the assessors concluded that 240 (23.8%) of under-fives were examined correctly and a correct provisional diagnosis/classification made but only a quarter of them, 259 (25.6%), had the final diagnosis correctly made based on available test results. The difference between clinicians in the intervention health facilities as compared to those in the control arm in terms of correct examination, correct diagnosis and correct prescription of antibiotics could be attributed to training and supportive supervision efforts given to the former with the support of THP.

5.2 Conclusions

The assessment observed poor compliance to IMCI algorithm more so in non-Tibu Homa sites than in Tibu Homa supported health facilities. This is evidedenced by a high rate of antimalaria treatment to non-malaria under fives (10%) and inappropriate antibiotics prescription of 23.3%.

The assessment further demonstrates that poor prescribing practices improved following Case Management training enhanced by regular supportive supervision and mentorship visits. This might explain why compliance was better in Tibu Homa supported health facilities

The referral health facilities were also inadequately equipped to support diagnosis in non-malaria fevers.

6.0 RECOMMENDATIONS

1. A qualitative study on why clinicians do not give correct prescription should be carried out to inform the design of an intervention to address the problem.
2. Case Management training should be rolled out; monitoring of health care worker compliance should be integrated in case management guidelines and supportive supervision should be maintained and on-the-job clinical mentorship should be provided during routine supportive supervision.
3. Laboratory services should be improved at referral healthy facilities to support improved diagnosis of referred patients with other causes of fever

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